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Research Note

Gastrointestinal Helminths of the Reticulate Gila Monster, *Heloderma suspectum suspectum* (Sauria: Helodermatidae)

STEPHEN R. GOLDBERG[1] AND CHARLES R. BURSEY[2]
[1] Department of Biology, Whittier College, Whittier, California 90608 and
[2] Department of Biology, Pennsylvania State University, Shenango Valley Campus,
147 Shenango Avenue, Sharon, Pennsylvania 16146

ABSTRACT: Examination of the gastrointestinal tract of 110 *Heloderma suspectum suspectum* Cope, 1869, revealed the presence of 1 cestode, *Oochoristica whitentoni* Steelman, 1939, and 2 nematode species, *Oswaldocruzia pipiens* Walton, 1929, and *Skrjabinoptera phrynosoma* Ortlepp, 1922. Helminth prevalence and mean intensity were 12% and 9.9, respectively. These findings represent new host records.

KEY WORDS: Cestoda, *Oochoristica whitentoni,* Nematoda, *Oswaldocruzia pipiens, Skrjabinoptera phrynosoma,* Helodermatidae, *Heloderma suspectum suspectum,* Gila monster.

The Gila monster, *Heloderma suspectum* Cope, 1869, is found from extreme southwestern Utah and southern Nevada through southern Arizona and southwestern New Mexico to northern Sinaloa, Mexico from sea level to about 1,520 m (Stebbins, 1985). The few reports of parasitism in this species mostly concern filariae. Smith (1910) recovered 4 adult filariae which he named *Filaria mitchelli*; they were reassigned to the genus *Piratuba* by Chabaud and Frank (1961a). Hannum (1941) described adult and microfilaria of *Chandlerella corophila* which were subsequently reassigned to the genus *Splendidofilaria* by Yamaguti (1961). Ryerson (1949) reported but did not identify microfilariae from 2 Gila

Table 1. Number, prevalence, and intensity of gastrointestinal helminths in 110 *Heloderma suspectum suspectum*.

Year	*H. suspectum* Male	*H. suspectum* Female	*Oo. whitentoni*	*Os. pipiens*	*S. phrynosoma* Adult	*S. phrynosoma* Third stage
1964	6	5	–	4	–	1
1965	13	11	1	67	1	–
1966	12	12	–	20	8	9
1967	3	1	–	–	–	–
1969	1	–	–	–	–	–
1985	34	12	4	26	–	–
Total	69	41	5	117	9	10
Prevalence			2%	5%	5%	
Mean intensity (range)			2.5 (1–4)	19.5 (1–67)	3.2 (1–8)	

monsters, 1 of which had adult filariae in the heart and aorta. Stabler and Schmittner (1958) recovered sheathed microfilariae which they named *Microfilaria stahnkei* (synonymized with *Piratuba mitchelli* by Chabaud and Frank [1961a]). In addition, Chabaud and Frank (1961b) described *Macdonaldius andersoni* from adult filariae found in abdominal arteries. Mahrt (1979) found microfilariae in *H. suspectum* that resembled *Macdonaldius seetae* which occur in snakes. Griner (1983) observed but did not identify filariae in the ventricle of a Gila monster. Goldberg and Bursey (1990a) redescribed the microfilaria of *Piratuba mitchelli.* The only other helminths that have been reported are an unidentified cestode and an unidentified acanthocephalan by Bogert and Del Campo (1956). The purpose of this report is to describe the prevalence and intensity of gastrointestinal helminths in an Arizona population of *H. suspectum suspectum.*

One hundred ten specimens were examined (mean snout–vent length, SVL = 244 ± 51 mm SD; range 110–344 mm). All were from the vicinity of Tucson, Pima County, Arizona (32°13′N, 110°58′W, elevation 701 m) and were collected over several years (Table 1). The body cavity was opened and the esophagus, stomach, small intestine, and large intestine were slit longitudinally and examined under a dissecting microscope. Nematodes were identified using glycerol wet mounts; proglottids of cestodes were stained with hematoxylin. One cestode species, *Oochoristica whitentoni,* and 2 nematode species, *Oswaldocruzia pipiens* and *Skrjabinoptera phrynosoma,* were recovered. Representative specimens were deposited in the U.S. National Parasite Collection (Beltsville, Maryland 20705): *Oochoristica whitentoni* (2 strobilae in alcohol), USNM Helm. Coll. No. 81198; *Oswaldocruzia pipiens* (6 males, 6 females in alcohol), 81199; *Skrjabinoptera phrynosoma* (3 males, 3 females, 81200, and 6 third-stage larvae, 81201, all in alcohol).

Prevalence, location, and intensity for each species are given in Table 1. *Oochoristica whitentoni* was found in the small intestines of 1 male and 1 female lizard. *Oswaldocruzia pipiens* was recovered from the small intestines of 4 male and 2 female lizards. Adult *Skrjabinoptera phrynosoma* occurred in the stomachs of 2 male and 1 female lizards; while third-stage larvae were recovered from 1 male and 2 female lizards. The frequency of infection was the same for female and male lizards (female, 5/41 = 12%; male, 8/69 = 12%) but there was significant difference in parasite load (Kruskal-Wallis statistic = 3.9, 1 df, $P < 0.05$); mean intensity for females was 1.6 and for males, 15.1. There was no significant difference in infection rates between the lizards of the 1964–1967 collection and the 1985 collection (Kruskal-Wallis statistic = 1.17, 1 df, $P > 0.05$).

Thirteen of the 66 described species of *Oochoristica* occur in North America; 8 have been recovered from lizards (Schmidt, 1986). Based upon our update of the key developed by Hughes (1940), only 1 species, *O. whitentoni,* has characteristics similar to the specimens that we recovered. The strobilae of our specimens averaged 300 by 2.0 mm with 230 proglottids and 115 testes compared to 275 by 1.3 mm with 211 proglottids and 100–150 testes for *O. whitentoni. Oochoristica whitentoni* was originally described from a land tortoise, *Terrapene triunguis* (=*ornata*), collected near Stillwater, Oklahoma (Steelman, 1939) and has also been reported from

a false iguana, *Ctenosaura pectinata,* from Mexico (Schmidt, 1986). Insects and mites serve as intermediate hosts (Schmidt, 1986).

Oswaldocruzia pipiens is the only trichostrongyloid to infect reptiles in the United States (Baker, 1987). It is a common parasite occurring mainly in amphibians, but has also been found in lizards: *Anolis carolinensis* by Conn and Etges (1984); *Leiolopisma laterale, Eumeces fasciatus, Sceloporus undulatus* by Harwood (1932); *Gerrhonotus multicarinatus* by Goldberg and Bursey (1990b), and the turtles: *Terrapene carolina* and *Terrapene ornata* by Ernst and Ernst (1975).

Skrjabinoptera phrynosoma has been recovered from a number of lizard species from North America (Baker, 1987). Its life cycle in the Texas horned lizard, *Phrynosoma cornutum,* has been elucidated by Lee (1957); the intermediate host is the ant, *Pogonomyrmex barbatus.*

None of the helminths reported here is host specific for helodermatids, but all are new host records. The low levels of infection and what is known about the life cycles of these helminths suggests accidental infections. Bogert and Del Campo (1956) noted that compared with other lizards, helodermatids appeared remarkably free of intestinal parasites and suggested that diet may be a factor in their lack of gastrointestinal helminths. Since eggs, fledgling birds and nestling mammals make up much of their diet, Bogert and Del Campo (1956) reasoned that these young animals would be less likely to be infected with larval stages and subsequently helodermatids would ingest fewer parasites. Because their diet is relatively insect free, helodermatids have few chances of infections by helminths with insect intermediate hosts. However, the inclusion of carrion in their diet (Stebbins, 1985) increases the probability of ants and beetles being consumed which may contain larval helminths.

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Research Note

Attraction of Amoebocytes to *Cyclocoelum oculeum* Rediae Entering the Snail Host

STEPHEN J. TAFT AND PATRICIA GASQUE
Department of Biology, University of Wisconsin–Stevens Point, Stevens Point, Wisconsin 54481

ABSTRACT: Sixteen-millimeter cinephotomicrography was used to study the attraction of amoebocytes to *Cyclocoelum oculeum* rediae entering the snail host, *Gyraulus parvus*. As the redia pushed against the lining of the peripheral blood sinus, amoebocytes emerged from among epithelial cells lining the sinus 10–14 μm away and migrated to the area of penetration within 7–10 sec. When the redia broke through the sinus, the amoebocytes attached.

KEY WORDS: Trematoda, Cyclocoelidae, *Cyclocoelum oculeum, Gyraulus parvus*, redia, amoebocytes, 16-mm cinephotomicrography.

Cyclocoelum oculeum miracidia each contain a fully-formed redia (Palm, 1963). After attachment of the miracidium to the snail host, the activated redia leaves the miracidium within an hour and enters the snail. While studying this process using cinephotomicrography, it was noted that amoebocytes were attracted to the site of redial penetration.

Even though there is an extensive literature on amoebocytes and their relationship to helminths (Bayne, 1983; Cheng et al., 1969; Joky et al., 1985; Sullivan, 1988), there has never been any in vivo filming of the attraction and attachment of these cells to entering parasites.

Adult *C. oculeum* miracidia were collected from the nasal cavities and orbits of American coots (*Fulica americana*) and placed in sterilized aquarium water. Their uteri were dissected out and teased apart to release miracidia. Miracidia were then placed along with the recently dissected head-foot of *Gyraulus parvus* on a clean microscope slide in a drop of water and mounted with a coverslip. Filming was accomplished using a Bolex 16-mm movie camera with attached Nikon Cine Autotimer mounted on a Zeiss Universal Microscope. Photographs were taken at 1-sec intervals using Kodak Plus-X positive film. Selected frames were printed as negatives to retain detail. Line drawings from the same frames were produced to further clarify the relationships.

The most common attachment site of the miracidium was to the snail's tentacle. This organ is covered by ciliated epithelium underlain by dense connective tissue, peripheral blood sinuses, and a central artery. After attachment, the apical papilla of the miracidium elongated and pushed against the connective tissue surrounding the peripheral blood sinus. Following this the enclosed redia became very active. Eventually the apical papilla retracted into the miracidium and the redia broke through the miracidial membranes, moved past the retracted papilla, and pushed up against the peripheral blood sinus causing it to invaginate. Apparently aiding in the breakdown of the miracidial membranes and snail tissues were substances produced by the redial esophageal glands. These glands can be seen decreasing in volume as the redia escaped the miracidium and entered the snail. On numerous occasions while filming, and also when making observations, 1–3 amoebocytes could be seen emerging from among epithelial cells lining the blood sinus. One such example is depicted in Plate I, Figures 1–6 and Plate II, Figures 1–6